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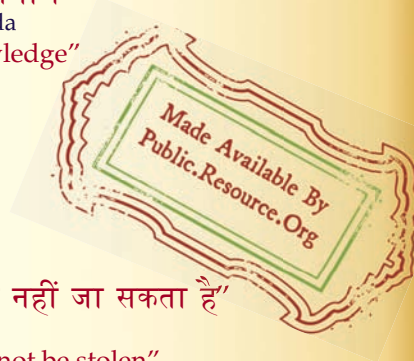
IS 8435 (1977): Methods for measurement of thickness of metallic coatings on plastics [MTD 24: Corrosion Protection]



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Indian Standard

METHODS FOR
MEASUREMENT OF THICKNESS OF
METALLIC COATINGS ON PLASTICS

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METHODS FOR MEASUREMENT OF THICKNESS OF METALLIC COATINGS ON PLASTICS

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Indian Standard

METHODS FOR MEASUREMENT OF THICKNESS OF METALLIC COATINGS ON PLASTICS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 29 April 1977, after the draft finalized by the Metallic Finishes Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 The measurement of thickness of metallic coatings on plastics may be carried out by selecting one of the methods outlined in this standard. Although microscopical method is recommended in relevant standards as referee method, instruments using magnetic or eddy-current or coulometric principle could also be used.

0.3 In reporting the results of test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS :2-1960*.

1. SCOPE

1.1 This standard gives an outline of available methods for measuring the thickness of electroplated coatings on plastics. Although, this standard is primarily related to decorative coatings on plastics, the methods referred to here may be used for measurement of conventional coatings on plastics or other non-metallic substrates.

2. MICROSCOPICAL METHOD

2.1 The microscopical method as given in IS:3203-1965† may be used.

2.2 This method applies to all metallic coatings applied to plastics. The grinding and polishing procedures as described in IS:3203-1965† may

*Rules for rounding off numerical values (*revised*).

†Methods of testing local thickness of electroplated coatings.

overheat the plastic specimen. Final polishing may be carried out on a low speed wheel using a suitable media. Where necessary, suitable reagents may be used to lightly etch the section to reveal the boundries between the coating and the plastics. Since the method is rather inaccurate when measuring coatings less than $2.5\text{ }\mu\text{m}$ thick, it should not be used for measurement of such coatings.

2.3 If etching is necessary the following etchants are suitable:

- a) Equal parts by volume of concentrated nitric acid (r.d. = 1.42) and glacial acetic acid.
- b) Equal parts of solutions of sodium cyanide (100 g/l) and ammonium persulphate (100 g/l).

CAUTION — Toxic fumes are evolved when solutions of these chemicals are used.

3. MAGNETIC METHOD

3.1 Instruments based on the magnetic principle may be used for the measurement of electro deposited nickel coatings on non-magnetic substrates including plastic materials. The method is described in IS : 3203-1965*.

3.2 Since the top layer of chromium is almost always very thin with respect to the underlying nickel coating, this method will permit the measurement of thickness of an electrolytic nickel coating deposited over copper or plastics without the removal of the top layer of chromium. This method is non-destructive.

4. COULOMETRIC METHOD

4.1 This method may be used for measuring the coating thickness of metals most commonly applied over plastic. It will also permit the measurement of the thickness of an individual layer in a composite coating, such as copper-nickel-chromium over plastic.

4.2 This method involves stripping of the plating anodically from a standard area and measuring the integration of time and current density. When coatings are tested for thickness by this method, a small accurately determined area of the surface is stripped by the stripping solution. At the same time a current is passed through the cell and the coating. The integrating circuit of the apparatus provides a reading based on the integration of the current density and the time taken to strip the plating.

4.3 Although this method is quite accurate in measuring metallic coatings on metallic substrates, its accuracy may sometimes be lower when measuring a metal coating applied over plastic. This method destroys the coating but not the substrate, which may be stripped and replated.

*Methods of testing local thickness of electroplated coatings.

5. EDDY CURRENT METHOD

5.1 Eddy current test instruments which employ a probe coil carrying a radio frequency alternating current may be used. This probe is placed close to the surface of the test specimen and the electromagnetic field of the coil induces an eddy current in the specimen. By virtue of the skin effect, the eddy current is confined to a surface layer. The frequency is so chosen that the eddy current penetrates the coating. The magnitude of the eddy current varies with the thickness of the coating, if the coating and the base metal differ appreciably in conductivity or in magnetic properties.

5.2 Eddy current test instruments may be used to measure single layers of metals applied over a plastic surface. Since this method depends on the conductivity of the coating, it will give accurate results only if the coating to be measured has a uniform, known conductivity. (For reference *see* IS:6012-1970*.)

*Method of measurement of coating thickness by eddy currents.

INDIAN STANDARDS

ON

METALLIC FINISHES

IS:

Electroplating

- 1067-1968 Electroplated coatings of silver for decorative and protective purposes (*first revision*)
- 1068-1968 Electroplated coatings of nickel and chromium on iron and steel (*first revision*)
- 1337-1968 Hard chromium electroplated coatings on iron and steel (*first revision*)
- 1359-1966 Electroplated coatings of tin (*revised*)
- 1378-1967 Oxidized-copper finishes (*first revision*)
- 1572-1968 Electroplated coatings of cadmium on iron and steel (*first revision*)
- 1573-1970 Electroplated coatings of zinc on iron and steel (*first revision*)
- 1771-1970 Electroplated coatings of silver for general engineering purposes (*first revision*)
- 1773-1961 Brass plating
- 1992-1962 Lead plating
- 3266-1965 Electroplated coatings of gold for general engineering purposes
- 4252-1967 Electroplated coatings of gold for decorative purposes
- 4827-1968 Electroplated coatings of nickel and chromium on copper and copper alloys
- 4828-1968 Electroplated coatings of nickel and chromium on zinc and zinc alloys
- 4942-1969 Electroplated coatings of nickel and chromium on aluminium and aluminium alloys

Codes of Practice

- 1985-1962 Pretreatment of steel, copper and copper base alloys, zinc and zinc base alloys for electroplating
- 1986-1962 Hard chromium plating on steel
- 3194-1965 Recommended practice for cleaning of metals prior to electroplating
- 3655-1966 Recommended practice for electroplating
- 3656-1968 Code of recommended practice for mechanical polishing of metals for electroplating

Methods of Tests

- 3203-1965 Methods of testing local thickness of electroplated coatings
- 5523-1969 Methods of testing anodic coating on aluminium
- 5528-1969 Methods of testing corrosion resistance of electroplated and anodized aluminium coatings by copper accelerated acetic acid salt spray (CASS) test
- 6012-1970 Measurement of coating thickness by eddy current

General

- 1868-1968 Anodic coatings on aluminium (*first revision*)
- 2679-1964 Recommendations for equipment for electroplating
- 3554-1966 Glossary of terms relating to electroplating
- 6009-1970 Method for evaluation of results of accelerated corrosion tests
- 6910-1973 Method of testing corrosion resistance of electroplated and anodized aluminium coatings by acetic acid salt spray test